Attorney Docket No. 7593 CO1
Customer No. 49459

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REMARKS

Claims 1, 9, and 10 have been amended. There is support in the specification for these amendments.

Rejection based upon 35 U.S.C. §103

Claims 1-17 have been rejected under 35 U.S.C. §103(a) as being obvious over Chattoraj et al. in view of Ridgway et al..

Applicants respectfully traverse the Examiner's rejection.

Chatteroraj et al. discloses a method of monitoring both the planktonic and sessile microbial populations in an industrial water system, including boilers and cooling towers, comprising the steps of: a) adding a fluorogenic dye directly into said industrial water system and allowing said fluorogenic dye to react with any planktonic or sessile microbiological organisms present; b) providing means for measurement of the fluorescent signals of said fluorogenic dye in said industrial water system, with the first fluorescent signal measurement being that of the fluorogenic dye and the second fluorescent signal measurement being that of the reacted fluorogenic dye; c) using said means for measurement of said fluorescent signals of said fluorogenic dye to measure the fluorescent signal of the fluorogenic dye and the fluorescent signal of the reacted fluorogenic dye, while discarding any measured fluorescent signal values below a predetermined noise level; d) calculating the Ratio of the measured fluorescent signal of the reacted fluorogenic dye to the fluorescent signal of the fluorogenic dye; and e) monitoring the change in calculated Ratio from step d) to determine the status of the planktonic and sessile microbiological populations in the industrial water system. This reference also discloses the additional steps of: 1) determining the optimal amount of biocide to be delivered to the industrial water system wherein said optimal amount is based upon the magnitude of said Ratio or the rate of change of said Ratio; and 2) delivering said optimal amount of biocide to the industrial water system. Moreover, the fluorogenic agent can be fed either by itself or in combination with water treatment agents that are typically fed into a cooling water system such as, but not limited to,

scale and corrosion inhibitors. Chattoraj does not specifically discuss the application of its monitoring technique to a membrane separation system.

Ridgway teaches how biofouling is a widespread problem limiting the performance and application of reverse osmosis and other membrane separation processes. The primary source of microbial contamination is typically the system feedwater; surface waters in particular contain high numbers of microorganisms which lead to microbial problems. With respect to monitoring and detecting membrane foulants, Ridgeway teaches the use of optical microscopy, scanning and transmission microscopy, atomic force microscopy, x-ray fluorescence emission microscopy, attenuated total reflection Fourier transform infrared spectrometry (ATR-FTIR), energy-dispersive x-ray microanalysis, and Auger spectroscopy. The reference also teaches that the information obtained from optical microscopy can be extended and quantified by the use of organic dyes which preferentially react with fluorescent probes such as 2,4-diamidino-2-phenylindole, 5-cyano-2,3-ditoyl tetrazolium chloride, and rhodamine. All these techniques directly measure membrane fouling with the detriment that the membrane has to be destroyed and extracted from the membrane system. <u>Nowhere is there any mention of monitoring biofouling in a membrane separation system by fluorescence</u>.

A prima facie case for obviousness requires the prior art references teach or suggest all the claim limitations of Applicants' invention and if the art teaches all the claimed limitations there must be a motivation by one of ordinary skill in the art to combine the references. *See In re Rouffet*, 149 F.3d 1350, 1357 (Fed. Cir. 1998); *In re Royka*, 490 F.2d 981, 180 USPQ 580 (CCPA 1974); MPEP 2143. Applicants respectfully traverse the Examiner's rejection because the prior art references when combined do not teach or suggest all the claim limitations. Neither Chattoraj nor Ridgway teach or suggest detecting fluorescence in the feed stream, a first stream, or a second stream. In particular the cited references do not teach the following limitations of claim 1: "providing a fluorometer to detect the fluorescent signal of the fluorogenic agent in <u>at least two</u> of the feed stream, the concentrate stream and the concentrate stream"; "using the fluorometer to measure the fluorescent signal of at least one of the fluorogenic agent and the reacted fluorogenic agent in <u>at least two</u> of the feed stream, the permeate stream, and the concentrate stream." (Emphasis added).

Assuming *arguendo* that all the elements of the invention were present in the cited references, a rejection based on obviousness would fail because a person of ordinary skill in the

art, possessed with the understandings and knowledge reflected in the prior art, and motivated by the general problem facing the inventor, would not have been lead to make the combination of the claims. Specifically, the understanding in the prior art is that fluorescence can be used as a tool for monitoring biofouling in an industrial water system and not specifically a membrane separation system, and that the presence of foulants in a membrane system can be monitored when the membrane separation system is shut down, the membrane is extracted, and the membrane is subsequently analyzed out of the system, for e.g. by reacting a portion of the membrane with a fluorescent dye for the presence of foulants (staining).

Membrane separation systems are a more complex and delicate subset of industrial water systems in that the amount of foulant to foul the membrane system and degrade performance is typically much less than the amount of foulant required to degrade performance of an industrial bulk water system, such as found in cooling towers and boilers, both of which are discussed in Chattoraj. Because of a membrane systems' propensity to foul with small amounts of biological material, one of ordinary skill in the art would not necessarily expect the analytical sensitivity of the methodology of Chattoraj be applied to monitoring fouling in a membrane separation system.

Moreover, one of ordinary skill in the art would not be motivated to study and measure at least two of the feed stream, the concentrate stream, and the permeate stream indirectly by monitoring the fluorescent signal of a fluorogenic agent, reacted fluorogenic agent, or a combination of both signals, let alone in an RO system, because the current fluorescence based techniques found in the art require that the membrane be extracted and analyzed as taught in Ridgeway.

The only motivation to make the claimed invention would come from the Applicant's disclosure, hindsight reconstruction, and that bases for motivation is not permitted by law. *In re Vaeck*, 947 F.2d 488, 20 USPQ2d 1438 (Fed. Cir. 1991); MPEP 2143. In view of the foregoing, Applicants request that the Examiner allow claim 1.

Considering that claims 2-17 depend upon an allowable base claim, claim 1, Applicants request that the Examiner allow claims 2-17.

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Rejection based upon Double Patenting

Claims 1-5 and 9-17 have been rejected under the judicially created doctrine of obviousness-type double patenting as being unpatentable over claims 1-15 of U.S. Patent No. 6,329,165 B1 in view of Ridgway et al.

Applicants respectfully traverse the Examiner's rejection.

Chatteroraj et al. discloses a method of monitoring both the planktonic and sessile microbial populations in an industrial water system, including boilers and cooling towers, comprising the steps of: a) adding a fluorogenic dye directly into said industrial water system and allowing said fluorogenic dye to react with any planktonic or sessile microbiological organisms present; b) providing means for measurement of the fluorescent signals of said fluorogenic dye in said industrial water system, with the first fluorescent signal measurement being that of the fluorogenic dye and the second fluorescent signal measurement being that of the reacted fluorogenic dye; c) using said means for measurement of said fluorescent signals of said fluorogenic dye to measure the fluorescent signal of the fluorogenic dye and the fluorescent signal of the reacted fluorogenic dye, while discarding any measured fluorescent signal values below a predetermined noise level; d) calculating the Ratio of the measured fluorescent signal of the reacted fluorogenic dye to the fluorescent signal of the fluorogenic dye; and e) monitoring the change in calculated Ratio from step d) to determine the status of the planktonic and sessile microbiological populations in the industrial water system. This reference also discloses the additional steps of: 1) determining the optimal amount of biocide to be delivered to the industrial water system wherein said optimal amount is based upon the magnitude of said Ratio or the rate of change of said Ratio; and 2) delivering said optimal amount of biocide to the industrial water system. Moreover, the fluorogenic agent can be fed either by itself or in combination with water treatment agents that are typically fed into a cooling water system such as, but not limited to, scale and corrosion inhibitors. Chattoraj does not specifically discuss the application of its monitoring technique to a membrane separation system.

Ridgway teaches how biofouling is a widespread problem limiting the performance and application of reverse osmosis and other membrane separation processes. The primary source of microbial contamination is typically the system feedwater; surface waters in particular contain high numbers of microorganisms which lead to microbial problems. With respect to monitoring

and detecting membrane foulants, Ridgeway teaches the use of optical microscopy, scanning and transmission microscopy, atomic force microscopy, x-ray fluorescence emission microscopy, attenuated total reflection Fourier transform infrared spectrometry (ATR-FTIR), energy-dispersive x-ray microanalysis, and Auger spectroscopy. The reference also teaches that the information obtained from optical microscopy can be extended and quantified by the use of organic dyes which preferentially react with fluorescent probes such as 2,4-diamidino-2-phenylindole, 5-cyano-2,3-ditoyl tetrazolium chloride, and rhodamine. All these techniques directly measure membrane fouling with the detriment that the membrane has to be destroyed and extracted from the membrane system. <u>Nowhere is there any mention of monitoring biofouling in a membrane separation system by fluorescence</u>.

A prima facie case for obviousness requires the prior art references teach or suggest all the claim limitations of Applicants' invention and if the art teaches all the claimed limitations there must be a motivation by one of ordinary skill in the art to combine the references. *See In re Rouffet*, 149 F.3d 1350, 1357 (Fed. Cir. 1998); *In re Royka*, 490 F.2d 981, 180 USPQ 580 (CCPA 1974); MPEP 2143. Applicants respectfully traverse the Examiner's rejection because the prior art references when combined do not teach or suggest all the claim limitations. Neither Chattoraj nor Ridgway teach or suggest detecting fluorescence in the feed stream, a first stream, or a second stream. In particular the cited references do not teach the following limitations of claim 1: "providing a fluorometer to detect the fluorescent signal of the fluorogenic agent in <u>at least two</u> of the feed stream, the concentrate stream and the concentrate stream"; "using the fluorometer to measure the fluorescent signal of at least one of the fluorogenic agent and the reacted fluorogenic agent in <u>at least two</u> of the feed stream, the permeate stream, and the concentrate stream." (Emphasis added).

Assuming *arguendo* that all the elements of the invention were present in the cited references, a rejection based on obviousness would fail because a person of ordinary skill in the art, possessed with the understandings and knowledge reflected in the prior art, and motivated by the general problem facing the inventor, would not have been lead to make the combination of the claims. Specifically, the understanding in the prior art is that fluorescence can be used as a tool for monitoring biofouling in an industrial water system and not specifically a membrane separation system, and that the presence of foulants in a membrane system can be monitored when the membrane separation system is shut down, the membrane is extracted, and the

membrane is subsequently analyzed out of the system, for e.g. by reacting a portion of the membrane with a fluorescent dye for the presence of foulants (staining).

Membrane separation systems are a more complex and delicate subset of industrial water systems in that the amount of foulant to foul the membrane system and degrade performance is typically much less than the amount of foulant required to degrade performance of an industrial bulk water system, such as found in cooling towers and boilers, both of which are discussed in Chattoraj. Because of a membrane systems' propensity to foul with small amounts of biological material, one of ordinary skill in the art would not necessarily expect the analytical sensitivity of the methodology of Chattoraj be applied to monitoring fouling in a membrane separation system.

Moreover, one of ordinary skill in the art would not be motivated to study and measure at least two of the feed stream, the concentrate stream, and the permeate stream indirectly by monitoring the fluorescent signal of a fluorogenic agent, reacted fluorogenic agent, or a combination of both signals, let alone in an RO system, because the current fluorescence based techniques found in the art require that the membrane be extracted and analyzed as taught in Ridgeway.

The only motivation to make the claimed invention would come from the Applicant's disclosure, hindsight reconstruction, and that bases for motivation is not permitted by law. *In re Vaeck*, 947 F.2d 488, 20 USPQ2d 1438 (Fed. Cir. 1991); MPEP 2143. In view of the foregoing, Applicants request that the Examiner allow claim 1.

Considering that claims 2-5 and 9-17 depend upon an allowable base claim, claim 1, Applicants request that the Examiner allow claims 2-5 and 9-17.

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CONCLUSION

Applicants respectfully request that a Notice of Allowance be sent for all pending claims.

Respectfully Submitted,

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